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ASSOCIATION OF

FEDERAL COMMUNICATIONS CONSULTING ENGINEERS

WASHINGTON, D. C.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
Advanced Television Systems	)	
and Their Impact Upon the	)	MM Docket No. 87-268
Existing Television Broadcast	)	
Service	)	

CONSOLIDATED OPPOSITION

of the

Association of Federal Communications Consulting Engineers

to

PETITIONS FOR RECONSIDERATION – SIXTH REPORT & ORDER

The Association of Federal Communications Consulting Engineers (AFCCE) has previously filed comments and reply comments in this proceeding and hereby presents opposition, in part, to several petitions for reconsideration filed with the Commission on or before June 13, 1997.

While most of the more than 220 petitions filed with the Commission are directed to the specific channel allotments of the various petitioners, AFCCE does not oppose their individual and collective efforts to seek more appropriate channels or operating parameters. There are clearly many cases of allotment inequities related to actual coverage replication as well as other issues related to interference caused or received, particularly in several egregious cases of adjacent-channel interference especially of the DTV-to-NTSC type. Remediation or mitigation of these problems is constrained, in part, by the lack of sufficient spectrum. AFCCE's opposition is directed to more fundamental engineering issues raised by several parties.

Several parties propose that the Commission reconsider the standards applied for defining interference within a station's service area, traditionally defined as the area within its Grade B contour. Specifically, it is proposed that additional interference, resulting from power increases in attempts to maximize DTV coverage, be defined in terms of the F50,50 curves for both desired and undesired signals for the area between the affected station's Grade A and Grade B contours. Presently, interference is defined in terms of F50,50 (desired) and F50,10 (undesired) fields.

This approach does not take into consideration the fact that the Commission's original planning factors for VHF/UHF television service assumed a 6 dB better C/I ratio at (and inside) the Grade A contour; instead of the assumed co-channel ratio of 28 dB[1/], the ratio at the Grade A contour is specified as 34 dB. Thus, in order to provide interference-free service at the Grade A contour, the interfering F50,10 signal level would have to meet the 34 dB objective. While the difference between F50,50 and F50,10 field values will vary with antenna heights and distances involved, it is clear that meeting the higher 34 dB C/I would negate a major portion of any "advantage" that might be gained from using F50,50 rather than F50,10 to compute interference between the Grade A and B contours.

Further, AFCCE believes that such increased interference should not be imposed on any broadcaster who may not wish to accept any degradation of its NTSC service; it is also noted that the Commission's rules permit stations to accept new interference based on negotiations between the parties which would seem to be the appropriate method for dealing with such interference.

AFCCE does not believe that sufficient empirical data exists to permit use of a new methodology to compute interference. It notes the present Grade B service is defined as the field strength exceeded at the best 50% of locations within the contour 90% of the time[2/]. Interference is defined to exist when the undesired field exceeds the C/I ratio (28 dB) at 50% of the locations 10% of the time. It appears that redefining interference, as proposed by these petitioners, would reduce service availability at the best 50%

[1/] For offset co-channel carriers.

[2/] The fading ratio is applied to increase the desired F50,50 field to F50,90 resulting in an F50,50 field strength of 64 dBu.

of the locations within the Grade B contour from 90% to 50% of the time; we believe any further consideration of this proposal requires the collection of additional empirical data, i.e., conducting extensive field strength measurement programs which demonstrate that such increases in interference would be acceptable.

Other Petitioners

AFCCE agrees in principle with the objectives of many of the petitioners but much of the technical basis for the petitions is based on assumptions/interpretations of the Commission's rules and the Sixth Report & Order. Also, since the date of filing the petition, the FCC has issued Bulletin OET-69 which sheds new light on the interference issues but also leaves some questions unanswered. Therefore, AFCCE believes that until these fundamental technical issues are resolved, it will be difficult for the industry and the Commission to arrive at a consensus as to interference and coverage determinations. The following is a list of examples:

- ***HAAT Calculation***
  Appendix B of the 6th R&O states that for DTV the HAAT will be determined using actual terrain data for 72 radials and linear interpolation at one degree intervals in between. OET's Bulletin #69 specifies that the HAAT for DTV will be calculated the same as that for NTSC, i.e., by averaging 8 radials at 45-degree intervals. Formal clarification is needed as to which one is correct (Appendix B or Bulletin OET-69).

- ***Scaling Rather than Truncating***
  By assigning a new DTV directional antenna pattern to each NTSC station, a pattern which cannot be matched with practical hardware, the FCC has in fact limited the ability of many stations to replicate their NTSC service. In addition, by scaling the newly derived pattern to 1 MW maximum, the FCC has also made it impossible for those stations to "maximize" their service inside their Grade B contour.

  The FCC should truncate the directional DTV pattern at the points where it exceeds 1 MW rather than scale down the entire pattern. By truncating, the principle of maximization would be better preserved.

- ***Misapplication of Dipole Factor***
  The sole reason for including the "dipole factor" in the planning factors for DTV is to mitigate the adverse effect that the "cliff-edge" would have the actual contour of UHF (and only UHF) channels. The inclusion of the "dipole factor" would then provide service parity among UHF-NTSC channels moving to UHF-DTV channels. By applying the "dipole factor" first to the Grade B contour of the UHF-NTSC stations, the FCC in effect nullified the original reason for applying this factor.

  There is also apparent inconsistency in the FCC's approach to determining the "true" Grade B contour of UHF stations (by applying the "dipole factor") and not adjusting the Grade B contour of VHF stations. It is well known that the "true" Grade B contour of VHF stations does extend well beyond the radio horizon as calculated in accordance with the FCC's rules.

  In any case, the correct UHF "dipole factor" is not ±2.3 dB. In AFCCE's reply comments of the 6th Further Notice of Proposed Rule Making it was shown that the correct "dipole factor" (including the downlead cable) is ±2.75 dB.

- ***Co-channel D/U***
  A note in Appendix E of the 6th R&O specifies that the D/U ratio of co-channel interference into DTV is a function of signal-to-noise ratio (SNR). Presumably the SNR refers to the victimized DTV channel although that point is not clear. The function that describes the allowed variation with SNR is not specified in the 6th R&O nor in the Bulletin #69. Further, the same note specifies SNR=16 dB as the edge of the noise-limited DTV service whereas elsewhere in the 6th R&O, SNR=15 dB is specified as the edge of the noise-limited DTV service.

The FCC should amend Appendix E and Bulletin #69 to include unambiguously the correct function and the correct noise-limited SNR for DTV.

- ***Interference Estimates***
  The D/U ratios recommended by the ACATS/ATTC apply at the input to the receiver. By ignoring the facts that the actual antenna patterns are going to be different that those used by the FCC, at times significantly[3/], and that the D/U ratio even for colocated adjacent channels is modified by propagation[4/], the interference calculated by the FCC is understated.

  Another source of error in the FCC analysis is rooted in misdiagnosing the limits of the Longley-Rice propagation model as outlined by Hammett & Edison[5/]. In effect, the FCC's method of analysis assumes, without justification, that no interference exists in those cells where the propagation model has failed.

  Another source of error is the failure to include the sideband splatter of DTV stations as a source of interference into adjacent channels. In a paper[6/] to be delivered at the IEEE Symposium in September, 1997, the point will be made that even the -46 dB level mandated by the proposed FCC mask at channel edges will not provide adequate protection to adjacent channels.

There are additional issues which relate to tolerances for a DTV station's antenna pattern, height and location.

The 5th and 6th R&Os allow a too-wide tolerance of 5 km for the location of the DTV antenna relative to the location of the paired NTSC antenna. The FCC has allowed zero tolerance for HAAT and zero tolerance for the newly mandated directional antenna patterns. This situation is untenable because the new DTV antennas cannot be installed exactly where the NTSC antennas are now, nor can the

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3/ For example, the directional antenna pattern mandated for DTV may not be replicated, and the standard elevation pattern as described in OET Bulletin #69 may not apply.

4/ This point was highlighted in AFCCE's reply comments to the 6th Further Notice of Proposed Rule Making.

5/ Petition for Reconsideration, June 13, 1997.

6/ C. Eilers and G. Sgrignoli, "An Analysis of the FCC's DTV Spectral Emission Mask by the Use of an NTSC Subjective Noise Weighting Function and the Potential Degradation due to Azimuth-Elevation NTSC-DTV Broadcast Antenna Differences."

directional antenna patterns assigned by the FCC be precisely matched with patterns available from practical antennas. On the other hand, a tolerance of 5 km (78.5 sq. km) on the transmitter location could result in unnecessary interference. The FCC should adopt practical tolerances for which no additional interference is assumed to be created. For example, tolerances of 25 meters for antenna height, ±2 dB for antenna pattern and a tolerance for antenna location which produces no significant interference.

Also, AFCCE believes that additional empirical data is required to determine the viability of the channel 2-6 spectrum for DTV operations. However, there is no conclusive reason to exclude channels 2-6 from the core spectrum for DTV. While it is true that the levels of sky and man-made noises are higher in those channels, they can be overcome by proper assignment of planning factors. In AFCCE's reply comments to the 6th Further Notice of Proposed Rule Making it was shown that the correct field strength for coverage planning, excluding man-made noise, would be 28.6 dBu if the average sky temperature is considered and 32.5 dBu if the maximum sky temperature is considered. It should be noted that the FCC changed the planning field strength from the 22.8 dBu specified in the 6th Further Notice of Proposed Rule Making to 28 dBu specified in the 6th R&O. Revising the planning field strength from 28 dBu to 32.5 dBu + a margin for man-made noise would allow the inclusion of channels 2-6 in the core spectrum without prejudice.

AFCCE is opposed to the continued reference to "field strength" in reference to DTV signals. In its earlier filings in this proceeding, AFCCE has recommended the use of either power flux density or the power received at the terminals of a reference antenna to define service. AFCCE reiterates that so far no one has succeeded in directly measuring the "field strength" of DTV. Any relevant textbook will show that a unique definition of RF field strength is associated with a unique wavelength. That is why field strength meters are tunable instruments which cannot be applied to DTV transmission. While it is true that some engineers have made the wrong assumption[7/] in order to convert the measured power into a "field strength", the actual measurement performed with a spectrum analyzer swept over a preset bandwidth. DTV contours should be specified in dBm or mw/cm^2, not dBu.

7/ That all the DTV power is concentrated at the carrier frequency rather than being spread over 6 MHz.

The Commission has proposed the use of a 7 dB noise figure for UHF receivers and this proposition has been supported or challenged by several petitioners. There is no apparent scientific basis for the 7 dB used in the planning factors for UHF. It was lowered from 10 dB as a result of broadcasters' complaints when faced with a capped and impractical ERP of 5 MW. A similar reduction in noise figure for VHF receivers was not adopted. The effective noise figure, the noise-figure subject to a typical mismatch between the receive antenna and the receiver's input, is higher by at least 3 dB for a VSWR of 2:1. VSWR as high as 5:1 can be expected in practical installations. Therefore, the receiver's noise figure, which is specified under a matched condition between source and load (VSWR=1:1), would have to be $\leq$ 4 dB if 7 dB is assumed to be the in-situ noise figure for coverage analysis. That is the noise figure of a typical LNA. The FCC has been properly concerned about the noise figure problem at NTSC receivers. Two comprehensive reports regarding the noise figure of TV sets were requested by and submitted to the FCC – one in 1979 and another in 1980. Ultimately, the application of unrealistic noise figures has resulted in unrealistic coverage analysis.

The FCC has recognized the fact that certain standards must be established for NTSC receivers to protect consumers and broadcasters. In the DTV environment, where more severe service problems unique to DTV are expected, the FCC should set minimum standards for a receiver's noise figure, equalizer and selectivity. Lack of minimal standards will result in waste of consumers' money and will severely hamper the adoption of DTV service.

The Commission has proposed the use of regional coordinating committees for the resolution of channel allotment issues. While AFCCE is not fundamentally opposed to use of such committees, it has significant reservations about the effectiveness of such bodies in resolving problems in a competitive environment. However, AFCCE again suggests the formation of an expert study group – which it previously labeled TASO II – to resolve the myriad technical issues relating operating parameters, coverage and interference which, at the end of the day, bear directly on allotment issues.

Finally, AFCCE does not believe that DTV facilities operating on channels 14 and 69 can be compatible with land mobile facilities in the adjacent spectrums. It is true that NTSC facilities have been constructed on a compatible basis but this has been accomplished with aggressive filtering and the "guard bands" afforded by vestigial sideband transmission and diplexed aural/visual transmitters; band edge attenuation in excess of -120 dB is not uncommon. This performance cannot be achieved with digital transmission due to envelope delay concerns and the wideband nature of the digital modulation.

Conclusion

AFCCE urges the Commission to consider the underlying technical issues as noted above before acting on these petitions for reconsideration.

Respectfully submitted,

THE ASSOCIATION OF FEDERAL COMMUNICATIONS CONSULTING ENGINEERS

John Hidle, P.E.
President
AFCCE

John F.X. Browne, P.E.
Chairman
Committee on Advanced Television Systems

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